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CASE FOR LIFE ON MARS WITHSTANDS CRITICISM, GAINS SCIENTIFIC SUPPORT

Researchers who stunned the world in 1996 with the announcement that a Martian meteorite contained evidence of ancient life on the red planet have released new evidence that strengthens their original hypothesis and allays many of the criticisms leveled at the first paper.

In this latest paper, published in the scientific journal Precambrian Research Feb. 17, two additional Martian meteorites were examined - Nakhla and Shergotty, 1.3 billion and 165 to 175 million years old, respectively. Both younger meteorites showed the same evidence of microfossils and other remnants of early life as the original meteorite, the 4.5-billion-year-old ALH84001. "If the features observed in the two younger Martian meteorites are confirmed to have a biogenic origin, life may have existed on Mars from 3.9 billion years ago to as recently as 165 to 175 million years ago," said Everett K. Gibson, a geochemist at the NASA Johnson Space Center in Houston and the senior author on the paper.

Clusters of very small spheres found in the two younger meteorites are very similar to those seen in bacteria-containing samples from deep beneath the Earth's surface in the Columbia River Basalts in eastern Washington. Whether or not these sphere-like structures are true biomarkers has yet to be determined, but the fact that they are embedded in or coated by clays that are clearly of Martian origin suggests that they too were formed on Mars.

Studies using a transmission electron microscope have provided further evidence of fossils in the original Martian meteorite, ALH84001. This evidence is in the form of tiny magnetite crystals, identical to those used by aqueous bacteria on Earth as compasses to find food and energy. Magnetite (Fe_3O_4) is produced inorganically on Earth, but the magnetite crystals produced by magnetotactic bacteria are different – they are chemically pure and defect-free, with a distinct size and shape. Magnetotactic bacteria arrange these magnetite crystals in chains within their cells.

Additional studies showed that a substantial portion of the hydrocarbons found in the meteorites were in them when they left Mars and are not the result of terrestrial contamination. There is also strong evidence that most of the carbonates in all three meteorites was formed at a time when Mars was warmer and wetter - an environment much more conducive to life than the current surface of Mars.

Terrestrial contamination of extraterrestrial samples is an issue not only with these meteorites, according to the authors, but one that is being studied in relation to the future return of Martian samples to Earth. "It's clear that we need to better understand the biosignatures of terrestrial and extraterrestrial samples so that when Martian samples are eventually brought back to Earth, we can determine the presences or absence of life with certainty," Gibson said. "However, if water exists beneath the Martian surface, why shouldn’t life be present today on Mars?"

The other authors of this work, which was funded by NASA’s Exobiology Program and NASA's Astrobiology Institute, are David S. McKay of JSC; Kathie L. Thomas-Keprta, Susan J. Wentworth, and Mary Sue Bell of Lockheed Martin at JSC; Frances Westall, a National Research Council Fellow at the Lunar & Planetary Institute in Houston; Andrew Steele and Jan Toporski of the University of Portsmouth, England; and Christopher S. Romanek of the Savannah River Ecology Laboratory. Of these, Gibson, McKay, Thomas-Keprta and Romanek were authors of the original paper on the subject.

For a more technical discussion of this paper please see the following Web site:

http://ares.jsc.nasa.gov/astrobiology/biomarkers/recentnews.html